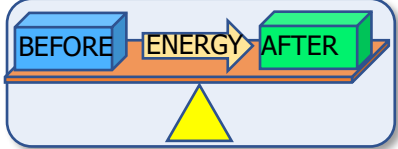
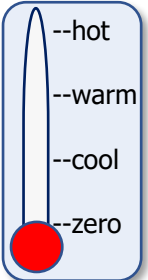



Ham 29 – Natural Law, Science, and Trade-offs

Dr. Marc & Rosemary © 220404

1. We have avoided much science and mathematics in our discussion of Ham Radio. We could just go with the old sayings that my dad and grandpas used, but the younger-set tend to dismiss those aphorisms and believe the science. So, we will have a little fun getting from the science to the old adages, which are critical to obtaining the best performance from your station. Relax. Stick your tongue in cheek.
2. First, natural law and science are the same thing. Science cannot make laws, but only observes what exists in nature. A cornerstone to understanding is the Triad Principle: *Any item that can be uniquely identified, can be further explained by three components.* There are no more and no less.
3. The Three Laws of Thermodynamics provide the framework of ALL energy manipulations. But, to keep the mathematically-challenged comfortable, we will not calculate. These laws are stated multiple ways, but all meaning precisely the same thing.
4. *First Law:* Energy cannot be created nor destroyed, but may only change form. Since energy is comprised of matter, space, and time, this law covers everything we know that exists. When we want to use numbers we state: The sum of the energy in a closed system is zero. Same thing, just different words. My grandparents said: There is no free lunch. My grandmother would say: you cannot get something for nothing. Politicians do not realize: somebody has to pay. See, your grandparents were deep-thinking scientists.
5. *Second Law:* Energy decays from a higher to lower potential with a loss transferred to the cosmos. Alternately: The entropy (disorder) of an isolated system always increases. Another way: Every energy conversion results in an unrecoverable loss. Or: Nothing gets better by itself without adding outside energy. My grandpa would never use such stilted terms but he would say: Everything rolls down-hill. Same thing, just different vernacular. The ancient scribe Malachi stated you must tithe (give to the cosmos) to receive energy back. Same thing.
6. *Third Law:* Energy loss approaches zero at an absolute temperature of zero. Grandpa would say, everything dies.
7. Well, it turns out that grandpa was a scientist, philosopher, and economics genius, who spoke plain language.
8. How does this apply to ham radio or any other situation? Every endeavor in the physical world is a trade-off between *time*, *money*, and *performance*. You can optimize two, but never all three.
9. Improved performance is generally our objective. We want best quality transmission for the longest distance. How do we get that? More \$\$\$ or hours, or both.
10. How do we improve performance? *Increase power, enhance antenna, elevation.*
11. It keeps going. Enhanced antenna means lots of metal in the air. If you have an antenna that is small enough to fit in an apartment, it cannot have the energy transfer of a huge antenna. If you use an antenna optimized for one band, it cannot have great performance on another.
12. Every location is different. Every wall is different. Every direction a building faces is different. Every surrounding is different with houses, trees, and electrical noise.
13. Remember when you started on the ham journey, we discussed that amateur radio is about experimenting. This is the story. There is no perfect set-up for everyone.
14. Just for VHF, I have seven antennas that I have experimented with and use for different purposes. For HF, there is another suite. Already in your short ham journey, you likely have three antennas: the original rubber-duddy for convenience, an enhanced handi-antenna for better performance, and a base antenna that works really well, but is not portable. See the trade-offs?
15. If you add a Compact antenna for in-house, that makes the home-owner-association happy and works pretty good on a couple of bands. Raise it up as high as you can and it is better. Trade-out for a co-linear and your performance jumps again, but it is much larger and only works on one-band effectively. And so it goes!
16. What is the ultimate station? How much money and time do you have? Oh, your bank account is not unlimited? You have a job and family? Those are some of the trade-offs.
17. For a beginner, the ultimate is a handi that lets them talk. It is less complex, less dollars, and small. As you morph to doing different things, improve your station in increments. Desirable is at least 50-watts, as big, and high an antenna as your trade-offs allow.
18. Life is good. Enjoy.

